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ABSTRACT

The National Center for Education Statistics supported this conference as a first step in a dialogue among forecasters to benefit all in the field. Fifty forecasters representing 20 different federal agencies attended the day-long session. Objectives of the conference include: (1) to bring forecasters together for a forum to share information on data quality and sources, forecasting methods, and forecast performance; (2) to build a Federal Forecasters Network; and (3) to establish a directory of Federal Forecasters. The keynote address is presented: "Solutions to Three Forecasting Problems" (J. Scott Armstrong). The three problems discussed include: predicting the actions of key decision-makers, bias in forecasts, and gaining acceptance of the forecast. Work sessions presented include: (1) Topic A--"Data Problems" (William Sonnenberg); (2) Topic B--"Forecasting Methodology" (Paul J. Horn); and (3) Topic C--"Forecast Evaluation" (Debra Gerald and William Hussar). The conference agenda, a listing of participants, and a bibliographic listing of 64 federal forecasting publications are appended. (SLD)

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NATIONAL CENTER FOR EDUCATION STATISTICS

Conference Report **January 1989**

Federal Forecasters Conference Proceedings

U.S. DEPARTMENT OF EDUCATION
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NATIONAL CENTER FOR EDUCATION STATISTICS

Conference Report January 1989

Federal Forecasters Conference Proceedings

April 25, 1988

Sponsored by the
National Center for Education Statistics

William Sonnenberg, Conference Chair
Debra Gerald
Paul J. Horn
William Hussar
Crosscutting Education Statistics and Analysis Division

U.S. Department of Education
Office of Educational Research and Improvement CS 89-636

U.S. Department of Education
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Office of Educational Research and Improvement
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Acting Assistant Secretary

National Center for Education Statistics
Emerson J. Elliott
Acting Commissioner

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Sharon K. Horn
Acting Director

National Center for Education Statistics

"The purpose of the Center shall be to collect, and analyze, and disseminate statistics and other data related to education in the United States and in other nations."—Section 406(b) of the General Education Provisions Act, as amended (20 U.S.C. 1221e–1).

FOREWORD

Through its activities, the National Center for Education Statistics of the U.S. Department of Education recognized that there was a need to bring together Federal Government forecasters to discuss issues in the field. While individuals have informally discussed data and methods, there has been no formal network that allowed forecasters from many Federal agencies to share information.

The Federal Forecasters Conference held on April 25, 1988 in Washington D.C., represents an important first step in organizing Federal Government employees who are involved in forecasting in the social, engineering, and behavioral sciences. The conference was designed to provide a forum to share information on data quality and sources, forecasting methods, and forecast performance.

Fifty forecasters representing 20 different Federal agencies attended the day-long session. The program included opening remarks by Office of Educational Research and Improvement and National Center for Education Statistics officials, work sessions, and presentations by experts in the field of forecasting from the private sector.

The following people are recognized for their participation in support of the first Federal Forecasters Conference:

William Sonnenberg of the National Center for Education Statistics for chairing the conference;

Bruno Manno of the Office of Educational Research and Improvement for his opening remarks;

Charles D. Cowan of the National Center for Education Statistics for his remarks;

J. Scott Armstrong of the University of Pennsylvania for his presentation;

Fred Collopy of the University of Pennsylvania for his demonstration; and

the discussion leaders and other forecasters from many Federal agencies for participating in the conference and sharing their knowledge about forecasting.

The assistance of many NCES staff is also gratefully acknowledged. Lisa Avallone, Debra Gerald, and William Sonnenberg were responsible for planning and organizing the conference. Debra Gerald also served as moderator for two of the sessions on forecast evaluation. William Sonnenberg moderated the sessions on data problems. Paul J. Horn moderated the sessions on forecasting methods, developed

the method for rotating the participants through the different sessions, and produced graphics. William Hussar was the moderator for a session on forecast evaluation and prepared the exhibit materials, while Celeste Loar also produced graphics for the conference. Lisa Avallone, Patricia Brown, Henry Gordon, and Charlene Hoffman monitored the exhibit of forecasting publications. Lisa Avallone and Celestine Davis prepared the conference materials. Paul R. Hall, Thomas Snyder, and Leo J. Eiden advised and supported the activities of the conference.

The efforts of these people and the conference participants made the forum a success and provide a model for future cooperation among Federal forecasters.

Emerson J. Elliott
Acting Commissioner,
National Center for Education Statistics

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OPENING REMARKS

FORECASTERS CAN LEARN FROM EACH OTHER

I would like to welcome you on behalf of Chester E. Finn, Jr., the Assistant Secretary of the Office of Educational Research and Improvement. The Assistant Secretary is pleased that the Center has arranged this first-time event. Under the leadership of Emerson Elliott, the Center has established new standards, developed additional reports, and improved the timeliness of reports. Problems dealing with the quantity, quality, and timeliness of education data are being solved.

The Center has been involved in forecasting for some time. During that time, it has developed national projections for elementary and secondary and higher education. These projections have been published in *Trends in Education, Targeted Forecasts*, and *Projections of Education Statistics*. The Center is developing State models and, as more data become available, trends on private elementary and secondary school statistics will be published.

Forecasters have much to learn from each other. The Center recognizes that forecasting is important, because it has an impact on policymaking. This forum will provide an excellent opportunity to share information on data quality and sources, forecasting methods, and forecast performance. In addition, this cooperation will strengthen forecasting on a variety of issues and will lead to more long-term discussion in this area and to better informed policymaking.

Bruno Manno
Chief of Staff
Office of Educational Research and Improvement

THREE CONFERENCE OBJECTIVES

The National Center for Education Statistics has initiated a number of outreach activities concerned with repairing its data bases through the redesign of surveys and applying the theory and methods of statistics to survey and sampling problems. While we should be mindful of data that are needed to address policy issues, we should equally be concerned with the technical aspects of forecasting. This meeting represents the first step in establishing a dialogue among forecasters that will benefit all of us.

There are three major objectives for this conference. The first objective is to bring forecasters together by providing a forum where forecasters from different agencies and disciplines can meet and share information on forecasting issues.

The next objective is to build a Federal Forecasters Network through which experts in the field will be able to discuss various forecasting problems. This can be done informally through increased contacts among individuals and formally through meetings such as this one.

The third objective is to establish a directory of Federal Forecasters. The forecasters directory, developed for this conference, lists more than 60 individuals involved in the profession. This is a notable beginning. But participants should work together to expand the number.

I urge you to meet forecasters from other agencies and share information on data sources, alternative forecasting techniques, and methods for measuring forecast performance.

Charles D. Cowan
Chief Statistician
National Center for Education Statistics

FEATURE PRESENTATION

SOLUTIONS TO THREE FORECASTING PROBLEMS

by J. Scott Armstrong

There are three problems that affect forecasting in general, but are of particular relevance to Federal forecasters. I selected these three problems because they are important and because research has yielded some solutions. President Eisenhower once said, "Things are more like they are now than they ever were before."

Three Problems

The three problems are:

1. Predicting the actions of key decisionmakers.

Forecasts are dependent upon the actions of key people. It is difficult to know what these people will do and when they will do it. For example, the U.S. Congress considers new economic sanctions to force the South African government to eliminate apartheid. How would the Afrikaners respond? How would the business community in South Africa respond?

2. Bias in forecasts.

Decisionmakers tend to use forecasts to support the decisions that they favor. Sometimes this is intentional and sometimes it is unintentional. To what extent are the forecasts influenced by this bias? How can these political influences be overcome? For example, a new minimum wage law is proposed in an effort to improve the living conditions of the disadvantaged. Congressman X favors a higher minimum. He asks his staff to obtain a forecast of the outcome.

3. Gaining acceptance of the forecast.

How can the forecaster gain acceptance of the forecast? This is a problem especially when the forecast is unpleasant and may call for change. For example, you receive a forecast that the legalization of drugs will greatly reduce crime, reduce drug dependency, increase the effectiveness of the judicial system, increase the GNP, and increase tax revenues. How will you react?

Dr. Armstrong is an Associate Professor at the Wharton School at the University of Pennsylvania. He is currently the editor of the *International Journal of Forecasting* and author of the book *Long-Range Forecasting: From Crystal Ball to Computer*.

If we had methods to solve the above problems, how could we effectively communicate the solutions? If communicated, how can we be sure that people will agree to use them? If they agree, will they use the method properly? You might ask what it would take for you to adopt one of these methods.

As knowledge is gained, how can the information be used to continually improve the forecasting system? How can the knowledge be applied when one is faced with the need to make a large number of forecasts in a short period of time?

The traditional solution for the implementation problem has been to improve our communication to the forecaster. Despite numerous shortcomings, this has provided benefits. Nevertheless, these benefits are probably not widespread.

An alternative solution is to ignore the forecaster. Instead, decision support systems would be provided directly to the decisionmaker. These systems would use inputs from the decisionmaker to create a forecasting model for the situation, make the forecasts, and show how these forecasts relate to decisionmaking.

The availability of high speed personal computers and the development of expert systems have converged to enhance the implementation of new methods of forecasting. Microcomputers can now analyze large data files and produce forecasts rapidly and inexpensively.

The term "expert system" has been defined in various ways. Expert systems for forecasting include all procedures for translating judgmental forecasting into an explicit, reproducible format that is independent of the expert. This includes the formulation of the problem, the selection of the proper forecasting method, and the use of the forecast in decisionmaking.

The benefits of expert systems are that they 1) help to identify the rules that forecasters are using in making forecasts; 2) produce improved rules; 3) apply the rules consistently; and 4) save money in situations that require many forecasts. Identifying the rules may reveal improper rules or expose unintended biases. For example, in trying to forecast which applicants would make the most successful employees, the development of an expert system may reveal that irrelevant factors such as height, sex, looks, accent, and education are being used. The formal encoding of the rules can show how each variable affects the forecast.

In producing improved rules, the expert system can draw not only on the forecaster's knowledge, but also on empirical evidence gained from this and similar situations or on findings reported in the literature.

Consistency provides a safeguard against biases. Using the expert system, the rules can be applied more consistently than they can be by the forecaster. The results are also more accurate even if the expert system relies only on the forecaster's rules.

The expert system can be used to structure the forecasting problem, that is to determine what decisions will be affected, what variables need to be forecasted,

what data are relevant, and how to structure the equations. The user provides various inputs and then the system recommends a problem structure, explaining why this is being done, even to the extent of providing literature references.

Once the problem has been structured, the expert system selects the appropriate forecasting techniques. These techniques would then be used to obtain the forecasts. This method of obtaining forecasts has already received some attention. For example, it has been found that the automatic Box-Jenkins models provide forecasts that are as good as those made by the leading Box-Jenkins experts.

The expert system for forecasting can then be linked directly to the planning and decisionmaking routines. This greatly reduces the likelihood of biases that might be introduced by the forecaster or by the decisionmaker, for that matter.

To date, the use of expert systems in forecasting has been confined primarily to the selection of an appropriate forecasting technique, given a well-structured problem and some inputs about the types of methods. Expert systems have neither addressed the structuring of the problem nor the use of the forecasts in decisionmaking.

Predicting Actions by Key Decisionmakers

One area that is of particular interest to government forecasters is how to predict the actions and reactions of decisionmakers in conflict. Consider the previously mentioned example about what would happen if the United States used new economic sanctions against South Africa? Or, what the response of various interest groups would be if the United States took action in Panama? Or, will country X devalue its currency? Or, how would people respond to a proposed major change in the tax law?

Role-playing is an especially promising technique for forecasting how decisionmakers in conflict would respond. Role-playing is valuable because it provides better insight into an opponent's thinking.

Bias in Forecasts

Agreement on good standards of forecasting is also useful in preventing or detecting bias. The use of such standards seem to be more important in government forecasting than in forecasting for the profit-oriented sector.

The problems of bias seem to be much larger in scope in the public sector. For example, does the government use adequate procedures to eliminate bias in forecasting the outcome of mass transportation projects, nuclear power plants, or synthetic fuels? An expert system could be used to pose proper questions for the forecasting situation. It would then identify what areas might be contrary to proper procedure, and what techniques can be used to overcome these problems. The system would utilize current expert opinion about the best practice as well as the latest research findings.

Gaining Acceptance of the Forecast

Forecasts on important topics meet resistance. Consider the following: Would an accurate forecast have been accepted by the U.S. Supreme Court in Brown v. Board of Education? That is, would it have affected the decision that led to school busing? Stephan (1978), in a followup of the predictions provided to the Supreme Court by social scientists, found that many of the forecasts that were used to support the decision were inaccurate. (He claimed to be among those who had made poor forecasts.) One forecast was that school integration would reduce racial prejudice. That did not occur.

One way to gain acceptance of forecasts is to use scenarios. The scenario involves converting the forecast into a story about the future. Recent research yields suggestions on how to write scenarios in order to gain acceptance of unusual or threatening forecasts. The use of vivid examples in the scenario is one way to attract attention. Another is to ask decisionmakers to write scenarios in which they are participants. Such approaches are likely to lead decisionmakers to take unusual forecasts more seriously.

An expert system could help a forecast gain acceptance by linking the forecast directly to the decision. Forecast simulations could be run to show exactly how the forecasts have an impact on costs and benefits when different rules are used. Outcomes with and without human intervention could also be compared. By asking for prior judgments and expected courses of action, the expert system can help identify forecasts that would be surprising. The system would then be used to help decisionmakers decide what forecast would lead to action and what the potential actions that might be taken would be.

Many of the solutions to the three problems are simple. Despite this, they are often ignored. The use of an expert system could lead to direct use of good forecasting procedures by decisionmakers. These decisionmakers may then say, "Goodbye forecaster."

WORK SESSIONS

Topic A: DATA PROBLEMS

Moderator: *William Sonnenberg*, National Center for Education Statistics

Discussion Leaders: *Ted Van Hintum*, Veterans' Administration
Russ Geiman, Internal Revenue Service
Naomi Verdugo, Department of the Army

Introduction

The area of data problems is a vast "gold mine" of discussion, but a vast "chasm of despair" when actually doing forecasts. As each participant explained his or her encounters with missing data, incorrect data, partial data, or multiple variations on each of these, it became evident that each lacked the kinds of data needed to do the job properly. Details of the discussions and some of the remedies for each of the three major categories of data problems are discussed below.

Missing Data

The problem of missing data became obvious from the first session as the dependence of agencies on each other's data was noted. For instance, if data collection for an item is suspended, then user agencies must adjust for this lack of data. Participants from the Veterans' Administration, the Bureau of the Census, and the Departments of Agriculture, Labor, Health and Human Services, and Education indicated that they experienced similar situations. The question arose, "What do we do about the lack of data?"

The most frequent remedy chosen was the use of similar data, modified with the advice of a number of experts. First, the forecaster uses judgment to estimate missing data. Then that guess is given to others who are thought to be experts in that area for their approval. Finally, the guess is verified over time and modified in future years to adjust for expert error.

Incorrect Data

The revelation by forecasters that vast shifts in data often occur, led to a lively discussion on the reliance other forecasters place on data that are often incorrect. "The man who has one watch knows what time it is," was the phrase used to describe a forecaster's normal methodology. That is, with data in hand from one respected source, the forecaster confidently predicts the future. He "knows" the past. Sometimes the forecaster is shocked to find that the past has changed, invalidating the forecast work. When the "watch" of history, the foundation of the

work, changes slightly, the forecast is weak or even destroyed. The question becomes, "What can we do about this?"

The answers to this question were less tangible. It would have been easy for such a discussion to break down into an accusatory session, with one group blaming another for such data errors that lead to forecast mistakes. Therefore, the discussion leaders directed this phase of the discussion to the more positive areas of 1) how we notify people of the caveats on our forecasts and 2) how we adjust rapidly to changes in other agency trend data.

In the area of caveats, all agreed that users do not read them. In general, people want a number, not an explanation. Some forecasters, noting horrible experiences in the past with this, indicated they will not provide information over the telephone. They insist the user get the data in writing. Thus, the provider is assured that the user receives background explanation information with the forecast. Others indicated that all tables they produce have confidence limits, and that information provided over the telephone also contains such limits. Therefore, if users choose to ignore the confidence limits, they do so "at their own risk."

As far as adjusting rapidly to other agency data changes, the groups all indicated that the easiest way to do that is to understand how an agency prepares its data. Certain modeling techniques may be adjusted more rapidly than others, but no forecasting operation can change printed materials or information given prior to the development of adjusted forecasts. Thus, increased understanding of each other's methodologies and data shortcomings are mandatory. How do we better understand each other's situation? All agreed that having better communication—specifically, having more such conferences and meetings—is the key. With the level of interdependence expressed by all parties, it was surprising that individuals who had routinely used each other's data met, for the first time, at this conference.

A type of data change that frequently occurs is the change in definition over time. This problem was discussed at great length. One aberration of this problem is the change, not of definition of a data item, but of the circumstances through which the data item was collected. A number of participants indicated that data appear to change when the position of a question on a questionnaire changes. Again, the only way to react positively to such problems is increased communication among forecasters. If users of data know in advance that a data item is either changing in definition or the collection procedures are being modified, then such concerns should be communicated. Many individuals indicated a willingness to consider user concerns with data collection modifications, if these concerns are known in advance. Such changes in data definition and collection lead to the final type of problem discussed—partial data.

Partial Data

Many forecasters indicated that models that have been developed and tested to be sufficiently accurate over time have been effectively destroyed by another agency's change in data. This leaves the model with only part of the data it needs. This problem is especially prevalent when data are provided by other agencies, such as

States. If only 48 of the 50 States provide information, the obvious question is, "Can this data be used?"

Reacting to this problem, the forecasters provided examples of forecasting to impute for missing entries in basic data. Thus, any forecasts using such basic data are "forecasts on forecasts." Therefore, the data problems described here may be self-perpetuating. If these data are not used because of lack of faith in the imputations, then there is insufficient or no data. In any case, circumstances are less than desirable at the outset of a forecasting task.

The consensus of the group was that data problems are universal and that more discussion is the key to resolving them.

Topic B: FORECASTING METHODOLOGY

Moderator: *Paul J. Horn*, National Center for Education Statistics

Discussion Leaders: *Gregory Spencer*, Bureau of the Census
Norman Saunders, Bureau of Labor Statistics
Stuart Bernstein, Bureau of Health Professions

Introduction

Participants were eager to share information about problems they encountered in producing forecasts. All who commented said they thought the conference was an excellent idea and hoped that further conferences would be held. Besides discussing specific methods of producing forecasts or projections, the participants also talked about simplicity versus complexity; the role judgment plays in forecasting; how to convey confidence in the model; political or policy influences on the forecasting process; and model implementation on computers.

Simplicity versus Complexity

Methods discussed were decomposition, time series (smoothing, moving averages, extrapolation), ARIMA, Box-Jenkins, regression, input/output, and judgment Simpler methods were emphasized over the more complicated ones. Many forecasters said that their agencies had recently abandoned a complicated model for a simple one. It was generally agreed that complexity in modelling is not a virtue. At least one participant characterized very complex models as black box models, where only the inputs and outputs are known, but where virtually nothing is known about the process that produces the forecasts. Others said that complex models are not as reliable and are harder to replicate, especially where components are adjusted by expert opinion. While simple models are viewed as being generally more accurate, less confusing, and easier to explain, it was pointed out that they quite often miss significant turning points in the data.

Disaggregation was also mentioned as leading to more complexity in the models. Highly disaggregated data tend to be highly variable, as well. Several forecasters said that while they do disaggregated forecasts, they would not want to show confidence intervals around them. While aggregated statistics are easier to deal with, often the forecaster must use the disaggregated data due to policymakers' concerns.

Predicting turning points was considered to be one of the major difficulties in using any method. Since the past is all forecasters have to work with, any models they produce will miss sudden changes which cannot be modelled. One-time changes,

such as major policy changes, new legislation, and court rulings are especially difficult to deal with. Expert judgment, backed by good, solid research, is felt to be most effective in dealing with these types of change.

Judgment

Expert judgment in one form or another appears to be rather widely used in Federal forecasting. Several agencies produce their forecasts using only judgmental methods. While it was felt that judgmental models have their uses, it was pointed out that they have serious disadvantages. Among the difficulties mentioned were difficulty in understanding the process that leads to a particular forecast and a perceived greater vulnerability to lawsuits. Several agencies are moving away from judgmental models because of this. Other participants pointed out that judgment plays a role even in the more statistical procedures. However, the more mathematical and statistical techniques were felt to be less of a problem in this way.

Confidence Limits

The discussion of confidence limits provided lively interchanges in every session. Forecasters seem to be divided between those who say that confidence limits are not needed since their users do not care about them, and those who say that users must be given some measure of confidence, whether they want it or not. Several speakers said that policymakers simply want a number, that they are not interested in upper and lower limits. Others felt that it is the duty of forecasters to educate their principle users about the meaning of confidence limits.

One participant observed that if there are significant policy implications and the high and low bounds are not presented, then a problem exists. An example of this is where the forecasts are used to decide whether or not to build a new sewage plant or school, for example. A simple point estimate might indicate that such a new facility would not be needed, where the interval forecast might indicate the opposite.

Politics and Policy

At several points, the implications of politics and policy on forecasting were discussed. Political and policy concerns can influence methodology in several ways. First, a method might be chosen to avoid the negative consequences of some other model. As one participant put it, "You won't get sued for extrapolation." Second, policymakers might dictate what method to use by the questions they ask. They are not interested solely in what is going to happen. They also want to know what might influence what will happen. Third, a change in the law or interpretation of policy might change the process that is being modeled. For example, the number of people participating in a program might drastically increase or decrease as a

result of alternatives to the formulas for eligibility. The consequences of such change might be impossible to model due to lack of data.

Computer Resources

Discussions of software used to forecast also generated a great amount of interest. Several agencies have developed models for the personal computer using spreadsheets. Other agencies use commercial statistical packages both on mainframe computers and on personal computers. Several speakers thought that it would be a good idea to have a clearinghouse for sharing models or software. Other resources discussed were electronic bulletin boards and user groups. Some agencies have tried contracting to produce models for forecasting, but have found the experience less than satisfying. The main reason mentioned for seeking outside help was lack of statisticians and economists on their staffs.

Topic C: FORECAST EVALUATION

Moderators: *Debra Gerald*, National Center for Education Statistics
William Hussar, National Center for Education Statistics

Discussion Leaders: *Howard Fullerton*, Bureau of Labor Statistics
Eileen Collins, National Science Foundation
Ben Klugh, Department of Agriculture

Introduction

The need to evaluate the performance of different forecasting models is essential In this session, participants shared information on model evaluation, methods to evaluate models and forecasts, and efforts to improve forecast accuracy in their agencies. Details of the discussions are presented below.

Model Evaluation Activity

There was a wide range of responses concerning the frequency of model evaluation. While many of the forecasters routinely evaluate their models and short-term results, few have done formal evaluation studies due to long forecast horizons or the lack of final data. A question on the frequency of formal evaluations yielded a range of responses from no formal review, to official reviews every few years, to those conducted annually. While a few forecasters had several years of data for evaluating model results, others had to evaluate models they had recently developed.

Model evaluations were found to serve a number of purposes. Some forecasters cited that the evaluations often cause further reconsideration of the model. Others noted that they cause a reexamination of the data.

Evaluation Methods

The most common measures of forecast accuracy used are Root Mean Square Error (RMSE) and Mean Absolute Percentage Error (MAPE). Other forecasters use Theil Decomposition to help improve forecast accuracy.

Some forecasters were concerned with methods to calculate errors. While these participants were more concerned with measurement and nonsampling errors, one forecaster noted that bootstrapping is used to examine errors.

Some of the participants compare their forecasts to others. Changes are made if there is a good reason. The participants generally agreed that comparing projections with the actuals may not always be the best way to measure accuracy. Rather, projections should be evaluated based on the conditions at the time of the forecast.

Improving Accuracy

The participants discussed problems that arise when several interrelated variables are being projected in the same agency. When several people are involved in forecasting individual components, lengthy discussions are held to reach a consensus on the final results. When forecasting both national and subnational variables, forecasters have to decide at which level it is most important to achieve a high degree of accuracy.

Some of the participants said they find it necessary to adjust results from models to account for people's behavior. One forecaster cited a study which shows that what people say they will do is a poor predictor of what they will actually do, for example.

APPENDIX

FEDERAL FORECASTERS CONFERENCE

Sponsored by the National Center for Education Statistics
Quality Inn Capitol Hill Hotel
April 25, 1988

TIME	ACTIVITY
9:00-9:30	Registration
9:30-10:00	**Welcoming Remarks** William Sonnenberg Statistician, National Center for Education Statistics Dr. Bruno Manno Chief of Staff, Office of Educational Research and Improvement Dr. Charles D. Cowan Chief Statistician, National Center for Education Statistics

Three (3) concurrent work sessions will run on different forecasting issues. Each session will accommodate 10-20 individuals. These are scheduled as follows:

SESSION 1	Topic A	Topic B	Topic C
10:15-11:15	**Data Problems** (What are they and how do you resolve them?)	**Forecasting Methods** (What types of models are used?)	**Forecast Evaluation** (What are you doing to improve forecast accuracy?)
	Discussion Leader: Ted Van Hintum Veterans' Administration	Discussion Leader: Dr. Gregory Spencer Bureau of the Census	Discussion Leader: Howard Fullerton Bureau of Labor Statistics
	NCES Moderator: W. Sonnenberg	NCES Moderator: Paul J. Horn	NCES Moderator: Debra Gerald
SESSION 2 11:30-12:30	Discussion Leader: Russ Geiman Internal Revenue Service	Discussion Leader: Norman Saunders Bureau of Labor Statistics	Discussion Leader: Dr. Eileen Collins National Science Foundation
	NCES Moderator: W. Sonnenberg	NCES Moderator: Paul J. Horn	NCES Moderator: Dr. William Hussar

2:00-3:30 **Feature Presentation**

"Forecasting: Problems and Solutions"
Dr. J. Scott Armstrong
Wharton School, University of Pennsylvania
Director, International Institute of Forecasters
Editor, *International Journal of Forecasting*

Demonstration

"The Time Machine" Forecasting Software Package
Fred Collopy
Wharton School, University of Pennsylvania

SESSION 3	Topic A	Topic B	Topic C
3:45-4:45	Discussion Leader: Dr. N. Verdugo Department of the Army	Discussion Leader: Stuart Bernstein Bureau of Health Professions	Discussion Leader: Ben Klugh Department of Agriculture
	NCES Moderator: W. Sonnenberg	NCES Moderator: Paul J. Horn	NCES Moderator: Debra Gerald

4:45-5:00 **Closing Remarks**
William Sonnenberg

Copies of attending agencies' forecasting publications are on display in the exhibition area.

LIST OF PARTICIPANTS

Tullio Albertini
Bureau of Health Professions

Trevor Alleyne
Congressional Budget Office

Darcel M. Battle
Bureau of Labor Statistics

William Bell
Bureau of the Census

Stuart Bernstein
Bureau of Health Professions

Douglas Braddock
Bureau of Labor Statistics

Jonathan Budd
National Institute of Justice

William Buffington
Veterans' Administration

Edwin Cissel
Foreign Agriculture Service

Joel Cohen
U.S. Postal Service

Eileen Collins
National Science Foundation

James Cultice
Bureau of Health Professions

Mary Jane Curran
Bureau of Labor Statistics

John Dickstein
Social Security Administration

John Drabek
Bureau of Health Professions

Allan Eck
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Edward Flynn
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Bureau of Economic Analysis

Chester Levine
Bureau of Labor Statistics

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William Losaw
Bureau of Health Professions

Steven McLaughlin
Veterans' Administration

Ralph M. Monaco
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Luda Murphy
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